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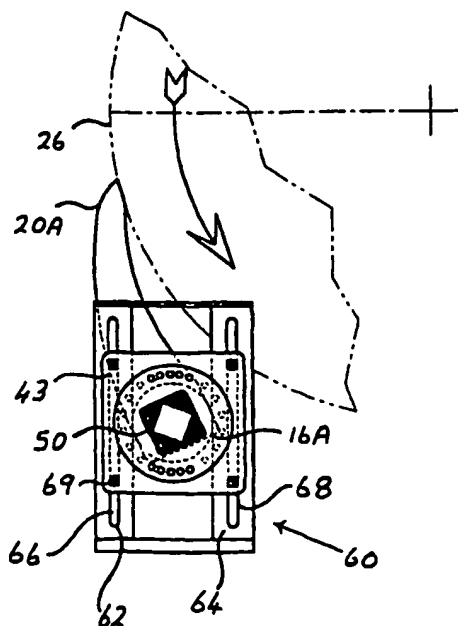
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(54) Title: **SCRAPER BIAS APPARATUS**



(57) Abstract: A torsion unit (14) for use with a conveyor belt scraper (12) which includes a tubular component (36), an extension member (38) which is located at least partly inside the tubular component (36), at least one resiliently deformable torsion element inside the tubular component which acts between opposed surfaces of the tubular component and the extension member, and a flange on the tubular component.



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SCRAPER BIAS APPARATUS

BACKGROUND OF THE INVENTION

This invention relates generally to scraper arrangements for conveyor belts and particularly is concerned with apparatus for biasing scrapers into contact with a conveyor belt surface at a location which is adjacent, near or on a head pulley.

A primary belt scraper or, more generally, a scraper at a head pulley of a conveyor belt, may be called upon to exert a substantial scraping action. To achieve this objective the scraper must be biased into scraping engagement with the conveyor belt surface which is to be cleaned, with a fair amount of force but in such a way that the scraper is deflectable, away from the belt, by significant obstructions on the belt.

The biasing arrangement which is adopted should be capable of being reset, from time to time, to compensate for wear on the scraper due to use. It is also desirable to be able to mount the scraper in different orientations to take account of different operative requirements

US patent 5,992,614 relates to a tensioning device which enables an adjustable force to be exerted on a shaft which supports a scraper blade. A spring is used to provide a resilient force applying mechanism.

The spring is not self-dampening and is exposed and hence is subject to corrosion. Another factor is that a scraper blade is mounted directly to the shaft in a fixed orientation.

A variation of this arrangement is shown in PCT/ZA98/19863.

EPO 583 731 shows a basic arrangement, which has a similar effect to the device of US 5 992 614, but wherein the biasing force is generated by twisting a resilient tube about its axis. Different mounting configurations are shown, but there is no positional adjustment facility. EPO 497 324 shows a similar arrangement.

SUMMARY OF THE INVENTION

10 According to one aspect of the invention there is provided a scraper arrangement for use with a conveyor belt which includes an elongate member to which at least one scraper blade is mounted, a support for the elongate member which allows at least limited rotation of the elongate member relatively to the conveyor belt with the scraper blade in scraping engagement with the belt, a tubular component which is mounted for at least limited
15 rotation relatively to the elongate member, at least one resiliently deformable torsion element, at least partly inside the tubular component, acting between the tubular component and the elongate member, and means for retaining the tubular component at a selected angular orientation with the torsion element in a deformed state.

20 The elongate member may be tubular.

An extension member may project from the elongate member.

The torsion element may act between the extension member and the torsion component.

The extension member may be located at least partly inside the tubular component.

The torsion element may be located at least partly inside the tubular component bearing against a surface or surfaces of the extension member which are within the tubular component.

In one form of the invention the extension member is angular e.g. has a square profile and the tubular component is also angular e.g. is also square in profile.

The square elongate member and the square tubular component may be displaced at 45° relatively to one another.

The torsion element may be one of four similar elements, each being of roughly triangular cross-section, inside the tubular component. The four elements may respectively be positioned at four inner corners of the tubular component, bearing respectively against four outer sides of the extension member.

The invention also provides a torsion unit for use with a conveyor belt scraper which includes a tubular component, an extension member which is located at least partly inside the tubular component, at least one resiliently deformable torsion element inside the tubular component which acts between opposed surfaces of the tubular component and the extension member, and a flange on the tubular component.

The flange may be located at an end of the tubular component and the extension member

may project from the tubular component at least at this end.

The torsion unit may be provided in combination with a scraper which has an elongate member, at least one scraper blade mounted to the elongate member, and mounting means to fix the elongate member to support structure so that the elongate member is rotatable at least to a limited extent relatively to the support structure, the extension member of the torsion unit being engaged with the elongate member and the combination including means for securing the flange of the torsion unit to the mounting means with the torsion element in a desired state of deformation.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described by way of examples with reference to the accompanying drawings in which:

Figure 1 is an end view of a scraper arrangement according to the invention,

Figure 2 is a side view of the arrangement shown in Figure 1,

Figure 3 shows a different type of scraper arrangement, with a height adjustment mechanism,

Figures 4 and 5 show a scraper blade which is mounted to an arm, in different orientations,

Figure 6 shows another scraper blade type, also on an arm, with height adjustment, and

Figure 7 is a side view of a mounting or bias system which is particularly suited for the arrangements of Figures 4 to 6 wherein the scrapers are mounted to arms.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figures 1 and 2 of the accompanying drawings illustrate a scraper arrangement 10 according to the invention which includes a conveyor belt scraper 12 and a torsion unit 14.

The conveyor scraper 12 includes an elongate tubular support shaft 16, which is square in cross-section, and which has a tapered channel section 18 secured to an upper surface. A plurality of scraper blades 20 are engaged with the channel section.

The shaft 16 is mounted to conventional fixed support structure 22, shown in dotted outline in Figure 1, adjacent a conveyor head pulley 24. A conveyor belt 26 passes over the pulley.

At one end the shaft 16 is supported by a bearing 28 which is mounted to a support plate 30 which, in turn, is fixed to the structure 22.

At an opposing end the scraper shaft 16 is supported by a bearing 32 which is fixed to a mounting bracket 34. The mounting bracket is fixed to the support structure 22 in any suitable manner.

The torsion unit 14 includes an outer torsion tube 36 and an inner torsion bar 38. The tube 36 is square in profile, see Figure 2. The torsion bar 38 is also square in profile but is angularly displaced relatively to the tube 36 through 45°. As is evident from Figure 1 the

torsion bar extends from the torsion tube 36 into the interior of the tubular support shaft 16. The extended torsion bar has two relatively small pieces 40 of rectangular steel bar fixed to it on opposing sides. The pieces 40 fit snugly inside the tubular scraper shaft and effectively link the torsion bar to the scraper shaft in such a way that rotation of the scraper shaft imparts rotational movement to the torsion bar, and vice versa. On the other hand it is relatively easy to engage the torsion bar with the scraper shaft for this is effected merely by sliding the torsion bar and the steel pieces 40 into the tubular interior of the scraper shaft.

The bearing 32 is in a housing 42 which is directly fixed, on one side, by means of a flange 43 to the mounting bracket 34. A flange 44 is fixed to an opposing side of the bearing housing.

A second flange 46 is fixed to the torsion tube 36. The flange 46 has a number of holes 48 formed through it, at spaced intervals, see Figure 2. The flange 44 has a series of holes formed in it. If the flanges 46 and 44 are rotated relatively to one another then different holes 48 are progressively brought into alignment with one of the holes in the flange 44. A bolt or pin can be passed through the holes which are in alignment and in this way the angular orientation of the flange 46, relatively to the flange 44, can be adjusted, within reason, and the flange 46 can then be locked in position. The holes 48 are spaced fairly close to one another and in practice permit the angular orientation of the flange 46 to be adjusted, relatively to the flange 44, in increments of $2\frac{1}{2}^\circ$.

Four torsion elements 50 are positioned inside the torsion tube 36. Each torsion element

is made from round rubber and, when compressed, has a substantially triangular cross-section. As is shown in Figure 2 each torsion element is located at an inner corner of the tube 36 and is in contact with a flat outer side of the torsion bar 38.

5 The angular position of the torsion bar 38 relatively to the shaft 16 is fixed through the medium of the steel pieces 40 which prevent relative rotation of the torsion bar and the scraper shaft. The shaft 16 is however rotatable, at least to a limited extent, about the bearings 28 and 32. The torsion tube 36, apart from the flange 46, is fixed to the torsion bar 38 only through the medium of the torsion elements 50.

10 If a rotational force is exerted on the torsion tube 36, using a suitable lever such as a spanner which is engaged with the torsion tube 36, then the resulting force is transmitted to the torsion bar via the rubber torsion elements 50. There is a tendency for the scraper shaft 16 to rotate in the same direction and in this way the scraper blades 20 can be urged
15 into scraping engagement with an outer surface of the conveyor belt 26 with a force which is dependent on the level of torque applied to the torsion tube 36.

The scraper blades 20 can thus be urged into scraping contact with the conveyor belt with a scraping force which is controllable depending on the extent to which the torsion tube
20 36 is rotated relatively to the fixed structure 22. When the torsion tube 36 is rotated the flange 46 rotates relatively to the adjacent flange 44, which it is to be noted, is not movable relatively to the fixed structure 22. A pin, not shown, is then inserted through the hole 48 which is in register with the locating hole in the flange 44 and the assembly can be locked in position.

If an obstruction on the belt 26 exerts substantial force on one or more of the scraper blades 20 then such blades are capable of deflecting in that the resulting force, generated by the obstruction, causes the scraper shaft 16 to rotate about its axis against the action of the torsion elements 50 which are further deformed to allow such deflecting movement to take place.

If scraping edges of the scraper blades become worn then the force which is exerted by the scraper blades on the conveyor belt surface is reduced. The force can be increased simply by rotating the torsion tube relatively to the fixed structure in a direction which compensates for the wear whereafter the two flanges 44 and 46 are again fixed to one another.

Figures 3 to 6 illustrate variations of the invention which is shown in Figures 1 and 2 and, where applicable, components which are the same in the various embodiments bear similar reference numerals.

Figure 3 shows an arrangement wherein the support shaft 12 and the torsion unit 14 are mounted to brackets 60 on opposing sides of the conveyor belt 26. The brackets are substantially identical and only one bracket is shown in Figure 3.

The bracket 60 includes two uprights 62 and 64 which are formed with respective elongate vertically extending slots 66 and 68. The flange 43 of the torsion unit 14 is attached to the bracket by means of bolts which pass through holes 69 in the flange and which are engaged with the slots.

It is apparent from an inspection of Figure 3 that the torsion unit and the belt scraper 12 are movable, in unison, upwards or downwards, according to requirement, in order to bring one or more scraper blades 20A into engagement with an outer surface of the conveyor belt 26. When the scraper arrangement is at a desired position the bolts are
5 tightened thereby to lock the flange 43 to the bracket 60.

The opposing side of the scraper arrangement, not shown in the drawing, is adjusted in a corresponding manner.

10 The scraper blade 20A may be attached to a support shaft 16A in a similar way to what has been described in connection with Figure 2, or in any other way.

The arrangement of Figure 3, viewed from the side, is generally as is shown in Figure 7. The construction is substantially the same as what is shown in Figure 1 and, as before,
15 if the torsion tube 36 is rotated relatively to the inner torsion bar 38 the torsion elements 50 between the tube and the torsion bar are distorted and thereby exert a resilient biasing force on the scraper blade 20A which urges the blade into resilient engagement with the conveyor belt 26.

20 In the arrangements of Figures 1, 2 and 3 the scraper blade or blades extend directly from the support shaft 16 which is co-axial with the torsion unit 14. In the arrangement shown in Figures 4, 5 and 6 the torsion units are displaced from the support shafts. Figure 4 illustrates an arrangement wherein the torsion unit 14 is mounted to a bracket 60 in a similar manner to what has been described in connection with Figure 3. An arm 70 (refer

to Figure 7 as well) extends from the torsion unit. The arm terminates in a clamp section 72 which has an inner semi-circular formation 74. A similar clamp section 76, also with an inner semi-circular formation 78, is engageable with the clamp section 72. The two sections can be fixed tightly together by means of bolts 80.

5

The support shaft 16, as before, has scraper blades 20A attached to it. This is done in any appropriate way. A mounting bush 82 is fitted over the support shaft. The bush is round in outline and is formed with a square hole 84 which is complementary in size and shape to the outer surface of the support shaft 16. Thus the bush can be threaded onto the shaft and moved to a desired position at which the bush is enclosed by the clamp sections 72 and 76.

10

The arrangement is such that when the clamp sections 72 and 76 are loose the scraper blades and the support shaft 16 can be rotated, in unison, to a desired angular orientation relatively to the arm 70. At this stage the bolts 80 are tightened and the scraper blades are then held in the desired orientation.

15

The configuration shown in Figure 4 thus permits sliding adjustment of the torsion unit and rotational adjustment of the scraper blades relatively to the belt which is to be cleaned. This is in addition to the adjustable bias which is provided by the torsion unit which has already been described.

20

In Figure 4 the scraper blades are at a leading outer surface of the conveyor belt directly opposite to the head pulley. Figure 5 shows an arrangement, which uses similar

components to what is shown in Figure 4, wherein the torsion unit is lower than the position shown in Figure 4 and the orientation is such that the scraper blades 20A extend upwardly and outwardly with what may be referred to as inner surfaces 86 in scraping engagement with the conveyor belt. This is in contrast to what is shown in Figure 4 which shows what is referred to as outer surfaces 88 of the blades in scraping engagement with the conveyor belt.

Figure 6 shows another embodiment with scraper blades 20B replacing the blades 20A shown in Figures 4 and 5. The arm 70 is substantially horizontal and the scraper blades 20B are positioned to extend vertically upwardly into engagement with an undersurface of the belt 26. The blades can be adjusted vertically by sliding movement relatively to the bracket 60, and rotationally by means of the clamp sections.

With each of the embodiments it is to be understood that, apart from the sliding and rotational adjustments of the scraper blades it is possible to vary the torsion force which is exerted by the torsion unit. The holes in the torsion unit flange are fairly close to one another and for example are spaced angularly apart by about $2\frac{1}{2}^{\circ}$. This makes it possible to vary the resilient torsion force in relatively small increments. Another possibility in this regard is to replace the torsion elements 50 with rubber of a different hardness. The lengths of the torsion elements which are inserted into the torsion tube 36 can also be altered. Another variable is the cross section of the torsion bar 38 and of the torsion tube 36.

The torsion unit operates through the bearing 32. The bearing is protected for it is fully

enclosed and it is therefore not exposed to corrosive effects. The same applies to the torsion elements which are protected inside the torsion tube.

With the arrangement shown in Figures 2 and 3 only one torsion unit will be required. If
5 the scraper arrangement includes an arm 70 of the kind shown in Figures 4, 5 and 6 then, due to the leverage which is exerted by the arm, it may be necessary to have more substantial support on opposed sides of the scraper blade. For example it may be necessary, depending on the requirements, to make use of two torsion units, on respective
10 opposed sides of the conveyor belt, instead of making use of a single torsion unit, as is shown in Figure 1.

CLAIMS

1. A scraper arrangement for use with a conveyor belt which includes an elongate member to which at least one scraper blade is mounted, a support for the elongate member which allows at least limited rotation of the elongate member relatively to the conveyor belt with the scraper blade in scraping engagement with the belt, a tubular component which is mounted for at least limited rotation relatively to the elongate member, at least one resiliently deformable torsion element, at least partly inside the tubular component, acting between the tubular component and the elongate member, and means for retaining the tubular component at a selected angular orientation with the torsion element in a deformed state.
2. A scraper arrangement according to claim 1 which includes an extension member which is located at least partly inside the tubular component and wherein the torsion element acts between the extension member and the torsion component.
3. A scraper arrangement according to claim 2 wherein the torsion element is located at least partly inside the tubular component bearing against a surface or surfaces of the extension member which are within the tubular component.
4. A scraper arrangement according to claim 3 wherein the extension member is angular and the tubular component is also angular.
5. A scraper arrangement according to claim 4 which includes four torsion elements

respectively positioned at four inner corners of the tubular component, bearing respectively against four outer sides of the extension member.

5 6. A scraper arrangement according to claim 5 or 6 which includes a clamp, engaged with the elongate member, which permits at least limited rotational adjustment of the scraper blade relatively to the tubular component.

10 7. A scraper arrangement according to any one of claims 1 to 6 which includes a mounting bracket and wherein the tubular component is mounted to the bracket for limited sliding adjusting movement relatively to the bracket.

15 8. A torsion unit for use with a conveyor belt scraper which includes a tubular component, an extension member which is located at least partly inside the tubular component, at least one resiliently deformable torsion element inside the tubular component which acts between opposed surfaces of the tubular component and the extension member, and a flange on the tubular component.

20 9. A torsion unit according to claim 8 wherein the flange is located at an end of the tubular component and the extension member projects from the tubular component at this end.

10. A torsion unit according to claim 8 or 9 which is provided in combination with a scraper which has an elongate member, at least one scraper blade mounted to the elongate member, and mounting means to fix the elongate member to support

structure so that the elongate member is rotatable at least to a limited extent relatively to the support structure, the extension member of the torsion unit being engaged with the elongate member and the combination including means for securing the flange of the torsion unit to the mounting means with the torsion element in a desired state of deformation.

11. A torsion unit according to claim 10 which includes a clamp which permits at least limited rotational adjustment of the scraper blade relatively to the torsion unit.

12. A torsion unit according to claim 10 or 11 which includes a bracket to which the tubular component is mounted so that the tubular component is slidably movable, to a limited extent, relatively to the bracket.

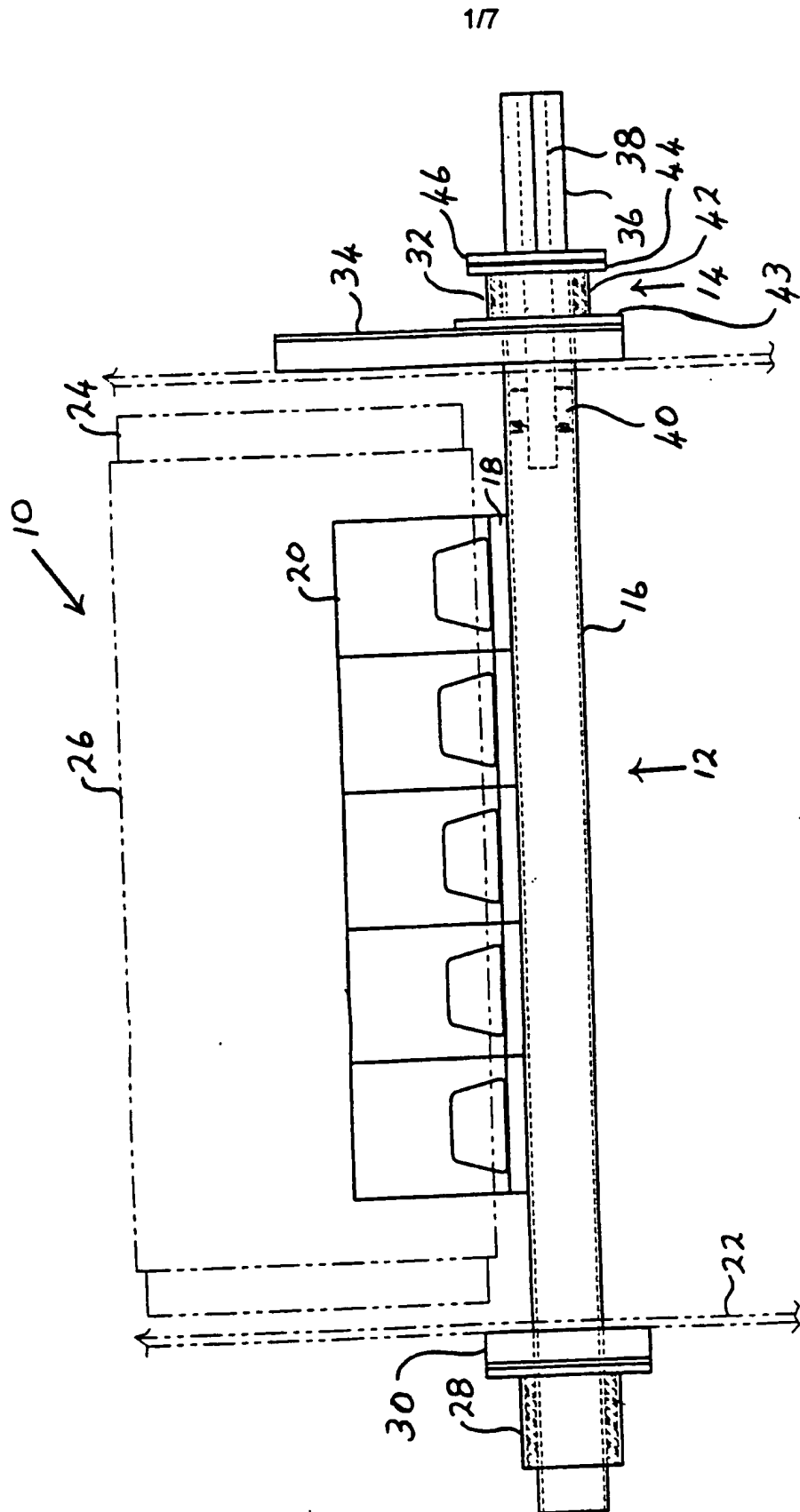


FIGURE 1

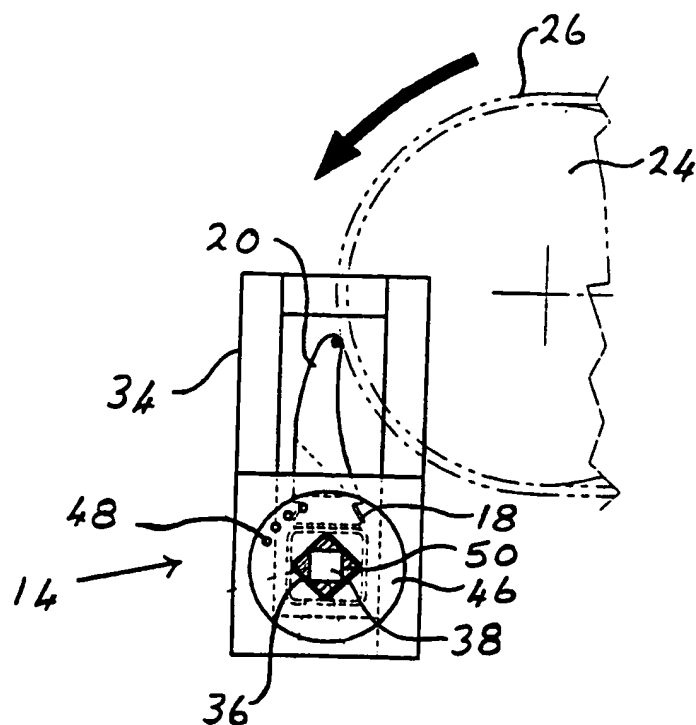


FIGURE 2

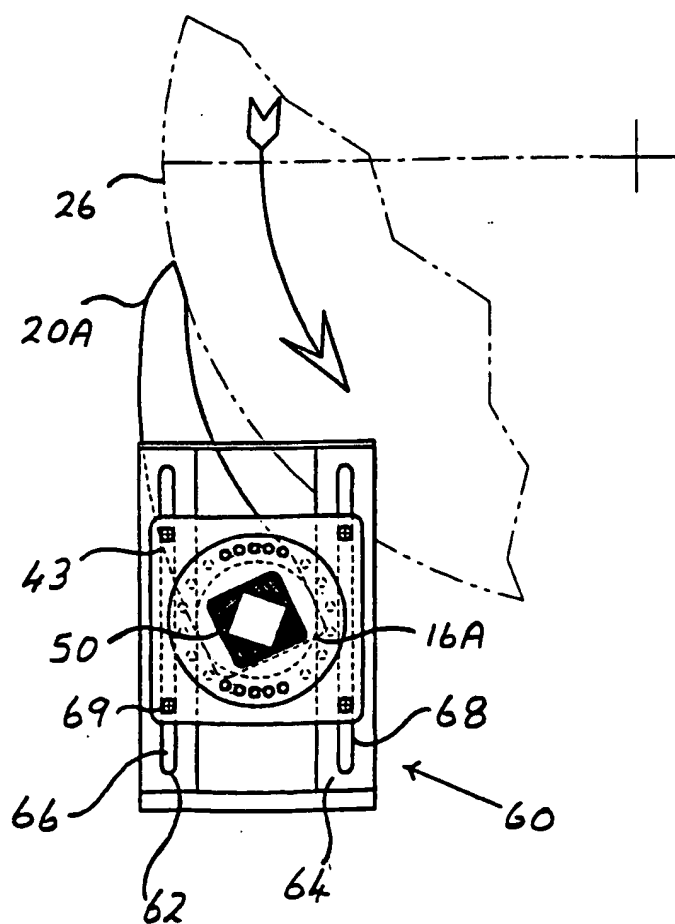


FIGURE 3

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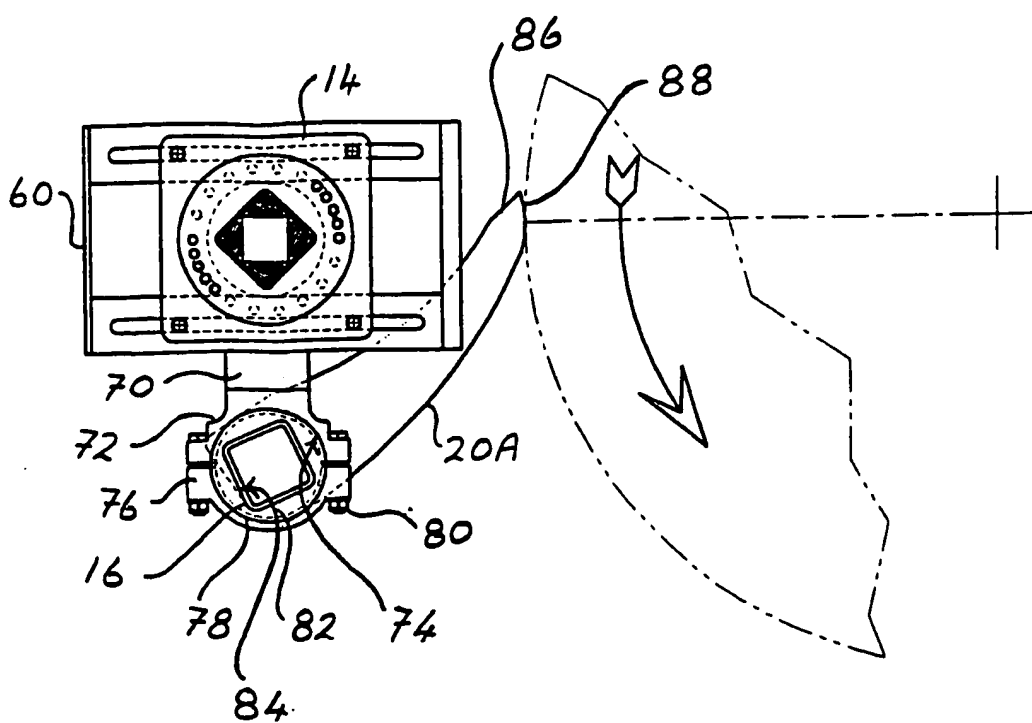


FIGURE 4

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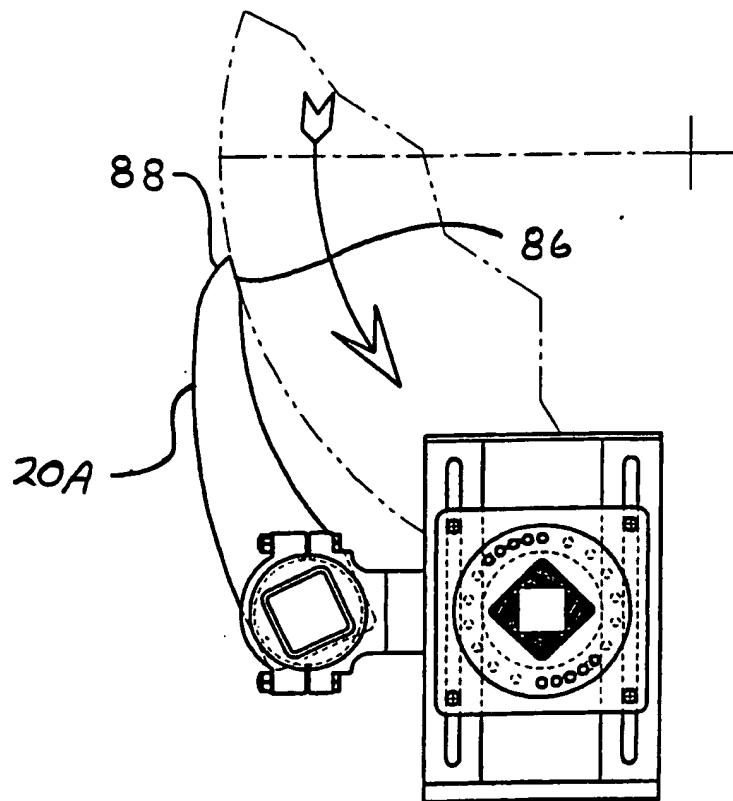


FIGURE 5

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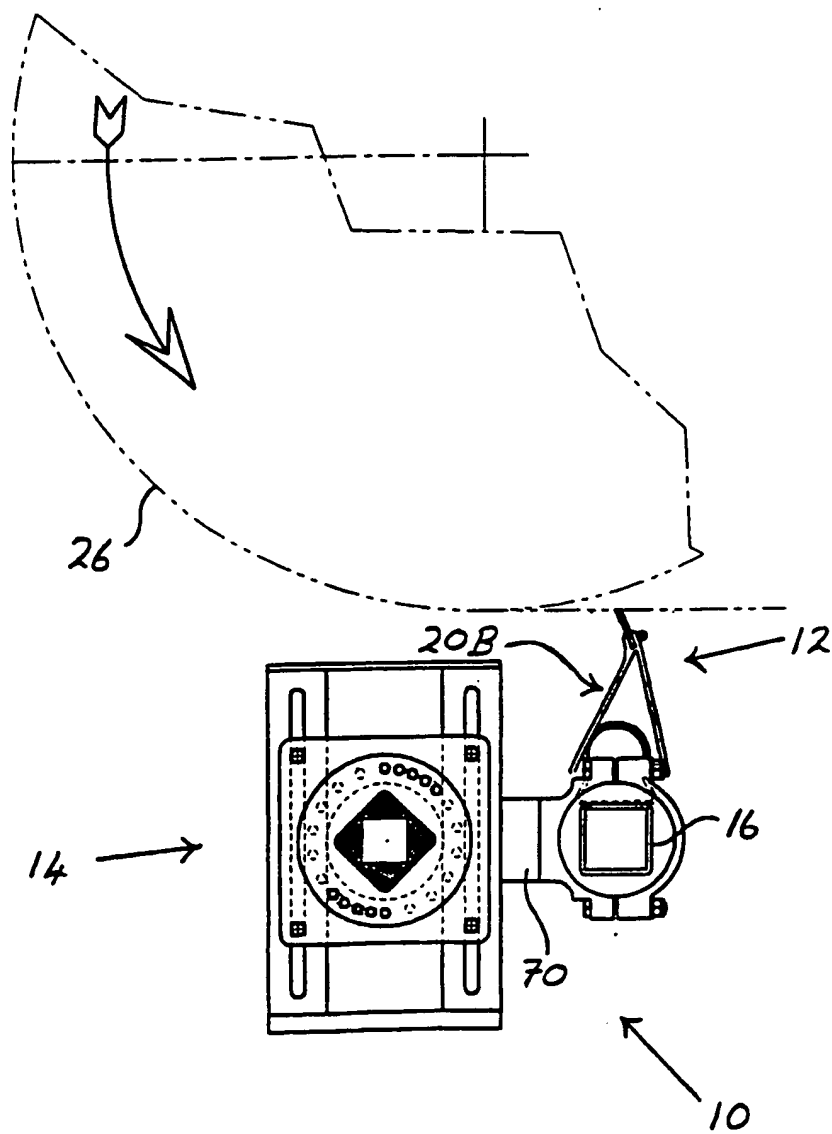


FIGURE 6

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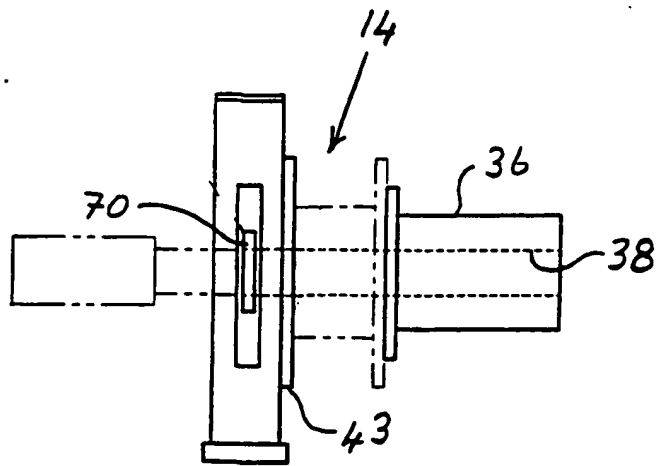


FIGURE 7

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/ZA 00/00115

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65G45/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No

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